Examining Intuitive Navigation in Airports

Andrew Cave, Queensland University of Technology, Brisbane, Australia (ar.cave@qut.edu.au)
Alethea Blackler, Queensland University of Technology, Brisbane, Australia (a.blackler@qut.edu.au)
Vesna Popovic, Queensland University of Technology, Brisbane, Australia (v.popovic@qut.edu.au)
Ben Kraal, Queensland University of Technology, Brisbane, Australia (b.kraal@qut.edu.au)

Abstract

Airports accommodate passengers with a range of prior experience, from frequent flyers, to passengers who fly every couple of years, to those who have never flown before. Passengers with varying levels of prior experience may use different visual elements when navigating the airport. Ensuring all passengers can navigate to the processing activities intuitively is important for passengers, airports and airlines.

This paper examines how participants with Low, Medium and High airport familiarity navigate through the departures area at an Australian international airport. Three navigation activities are investigated (i) navigating to the check-in row, (ii) navigating through the Liquids, Aerosols and Gels (LAGs) preparation area before security screening, and (iii) navigating to either the boarding gate first or to a discretionary activity first, after exiting customs. In the three activities, differences were observed between the familiarity groups. These differences include the use of different information to locate the check-in desk, different actions when navigating through the LAG preparation area, and evidence that Low familiarity passengers have a desire to locate the boarding gate as soon as possible once through customs. This research provides evidence based design reccomendations for airports to benefit from intuitive passenger navigation.

Keywords

Wayfinding; Navigation; Intuition; Airports; Design

As an increasing number of passengers are flying each year (Bureau of Infrastructure, 2010; Mather, 2012), airports need to ensure passengers can navigate easily and efficiently through the terminal. This is a challenge as airports must deal with a range of users, from passengers who fly regularly, to passengers who fly very occasionally, to those who have never flown before. A number of researchers have identified that passengers can have difficulty navigating through airport terminals (Cave, Blackler, Popovic, & Kraal, 2013; Fewings, 2001; Tam & Lam, 2004) which can result in a less than optimal airport experience. Terminal navigation and appearance was found to be the most important factor for increasing passenger satisfaction at Heathrow airport (Lopez, 2013) and in prior research by Caves and Pickard (2001), wayfinding was noted as one of the primary concerns affecting passenger satisfaction at a terminal.

For airports, installing and maintaining signs and other wayfinding systems is not inexpensive, nor is it a small undertaking. Estimates indicate it would cost approximately 10 million GBP to upgrade wayfinding signage in Heathrow airport (Montgomery, 2013). Wayfinding upgrades at Dubai airport required changing over 1500 signs (Future Travel Experience, 2013). Despite the cost associated with wayfinding systems in airports,

passengers can still have difficulty making it to the boarding gate on time. Rhodes (2010) cites Colin Lippiatt (manager of public affairs for the Virgin Blue group of airlines) who identified that 2.7% of Virgin Blue flights are delayed due to boarding related issues. Delayed flights, particularly those due to passengers not being at the boarding gate on time, have implications for passengers, airports and airlines. Passengers who are not at the boarding gate on time may delay the flight, which may not only affect the flight, but other flights and airports as well through further delays and missed connections. There are also financial implications for airports, as the more time passengers spend deciding where to go, the less time is available for passengers to spend money in retail areas, and those who encounter difficulty or stress may be less inclined to make a purchase. While the potential exists for airports to benefit by providing easy and effective passenger navigation, it seems there is little research showing how to provide it.

To ensure departing passengers are at the correct boarding gate in time for a flight, they are required to navigate to various way-points and complete a series of activities. Kraal, Popovic and Kirk (2009) categorised passenger activities into two groups (i) processing and (ii) discretionary. Processing activities can be defined as "those which are directly related to conforming to the legal and regulatory requirements that must be followed to get on a plane" (Kraal et al., 2009, p. 349). In Australian international airports there are four main processing activities that passengers are required to complete: (i) check-in, (ii) security, (iii) customs, and (iv) boarding the plane (Figure 1). Internationally, and even domestically, there can be variation in the sequence of processing activities, for example passing through security screening first before checking-in, or passing through security screening at the boarding gate. Between processing activities, passengers can engage in discretionary activities, such as retail shopping, dining and using viewing areas. Not all passengers will engage in discretionary activities, and where engagement occurs can vary depending on a number of factors (Harrison, Popovic, & Kraal, 2013; Livingstone, Popovic, Kraal, & Kirk, 2012).

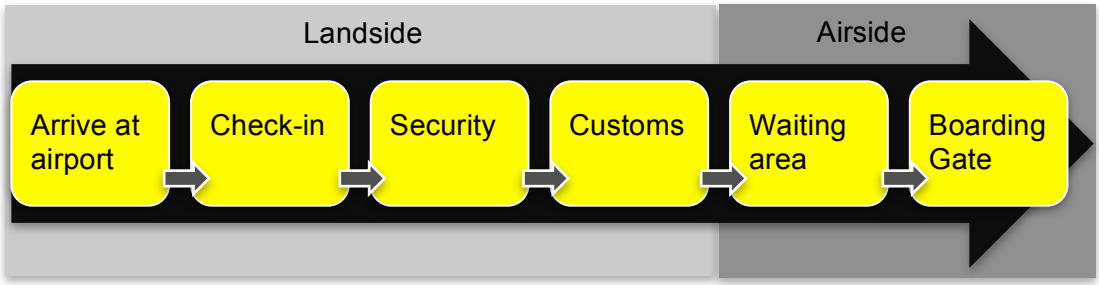

Figure 1. Processing activities of departing passengers, adapted from Popovic, Kraal, and Kirk (2010)

Navigation in airports

The terms wayfinding and navigation are often used interchangeably, for example by Downs and Stea (1977). This paper will use the term navigation in preference to wayfinding as Butler, as cited in Thi Pham (2012), noted that the term wayfinding design often implies a strong focus on signage.

Navigation is an everyday process in which people move between points. From the work of a number of authors, including Lynch (1960), Passini (1984) and Fewing (2001) navigation can be defined as the movement of people through the environment, utilising perceived environmental elements and human cognition to reach an intended destination. Human navigation can be highly complex, as the navigator has both cognitive and physical abilities. Cognitive abilities can include prior experience with the environment at hand, or strategies learned from navigating in similar environments. Physical abilities

include the senses and can vary between navigators, for example some navigators have excellent vision, while others have limited vision. A passenger may navigate individually through the airport, or with travelling companions.

For a passenger navigating through the airport, there are a range of visual elements present in the airport environment. These visual elements can include structures (for example check-in desks and security screening structures), information (for example directional signs) and spaces (for example pathways or entrances). In addition, the passenger will navigate through the airport with other passengers and visitors present, as well as airport and airline staff. In a passenger survey by Churchill, Dada, de Barros, and Wirasinghe (2008), it was found that most people identified signage as the main element used to find their way through the terminal, while others responded that they had used nothing at all. While signage may be one of the imporant visual elements used, it is important to note that there are a number of potential causes of navigation difficulty, including the building design, internal layout, internal design, number of decision points, length of the corridors, number of level changes, and length of the chosen path (Churchill et al., 2008; Fewings, 2001).

The importance of observing passengers in real world settings was highlighted by Schwarzkopf et al. (2013), who examined differences between reading signs in a real airport versus reading signs in a virtual airport. Schwarzkopf et al. (2013) noted that in real world wayfinding there are variables including other signage, peripheral objects, as well as other people present. Observational research examining which visual elements passengers use to navigate has been limited and instead surveys have often been used to collect data. For example Tam and Lam (2004), Braaksma & Cook (1980), Correia, Wirasinghe & de Barros (2008) and Churchill et al. (2008). Additionally there are now a range of new technologies that could be used to help people navigate e.g. interactive electronic signage and mobile device applications (including using location tracking and GPS). While these navigation aids could be useful to passengers, there are still practical limitations, such as usability for passengers, as well as the cost to airports, to overcome. To develop innovative and effective design solutions there needs to be a deeper understanding of where and why current navigation problems occur.

Intuitive navigation in airports

Ideally, passengers would be able to navigate easily and efficiently, with minimal conscious effort through airports. To achieve this, the theory of intuitive interaction can be transferred to the airport context. Intuitive interaction with products/systems is evident through interactions that are fast, semi conscious and generally correct (Blackler, 2008; Blackler, Popovic, & Mahar, 2010). What enables intuitive interaction is familiarity with the features of the product/system in question, or other similar products/systems/features (Blackler, 2008). The link between intuitive interaction and technology familiarity has been firmly established (Blackler, 2008; Blackler et al., 2010; Hurtienne & Blessing, 2007; O'Brien, Rogers, & Fisk, 2008). Through using features familiar from the user's previous experience, it is possible to reduce the amount of learning required as many features are already understood (Blackler, 2008). Designing airports that are intuitive to navigate requires an understanding of what prior experience passengers have of airports or other similar navigation tasks, however there is currently little knowledge about what elements passengers are familiar with in airports.

Examining navigation within a building, Hölscher and Brösamle (2007) established that familiarity with the building in question can lead to improved navigation performance. In the context of the airport environment, evidence for the link between intuitive navigation and prior experience with airport environments was found and is discussed in detail in Cave et al. (2013). In that research, participants were observed navigating through an

aiport and three navigation states were coded: (i) Going/doing, (ii) Assessment/acquire information and (iii) Search. Going/doing and Assessment/acquire information were coded as either intuitive, partially intuitive or not intuitive while Search was coded as either focussed or unfocussed (Table 1). Examining the three states of navigation, participants with Low airport familiarity were found to spend more time searching for information or where to go, and spent more time Assessing/acquiring information from the environment. In contrast, participants with High airport environment familiarity spent more time in Going/doing, and spent a higher percentage of Going/doing and Assessment/acquire information navigating intuitively. With a link between familiarity and intuitive navigation identified, this paper will examine what this means in practical terms for airport design.

Method

To understand how passengers navigate through airport terminals, observational research was conducted at Brisbane International Airport (Australia) over a 9 month period between March and November 2012. In total 30 participants navigated through departures to a boarding gate wearing the Tobii eye tracking glasses (Tobii Technology, 2010) (Figure 2). In addition, participants completed an Airport Environment Familiarity (AEF) questionnaire. The eye tracking glasses provided both video footage of the navigation process from the participants viewpoint, as well as where the participants eye focussed in the scene (Figure 2). Think-aloud protocol was used to capture (via audio recording on the Tobii glasses) what participants were looking for or looking at while navigating (Ericsson, 2006).

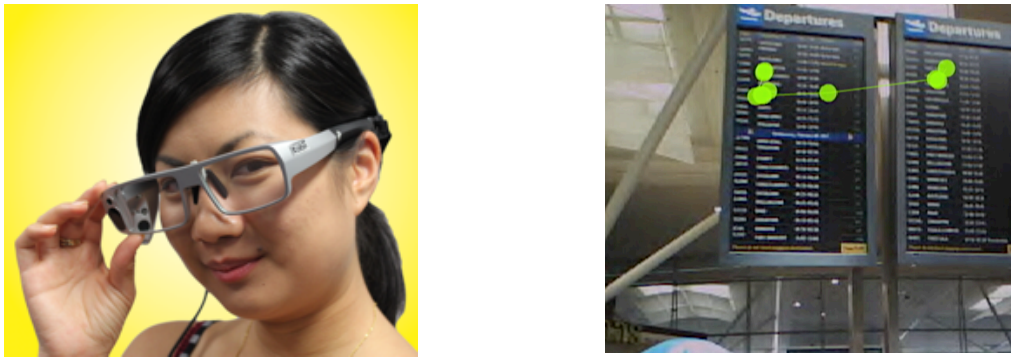

Figure 2. Tobii Glasses eye tracking system (left) and footage showing eye tracking overlay (right)

Participants

The age of participants ranged from 19 to 67 years, and an equal number of each gender was recruited (15 males, 15 females). Of the 30 participants recruited, 27 were participants who simulated catching a real flight, and 3 were actual passengers who caught a real flight. Participants ranged from those who had never flown internationally before and had never been through the airport before, to participants who fly internationally out of the airport every 1 to 3 months.

Procedure

Real Flight participants (RF participants) were met in the departure drop off zone, and were fitted with the glasses before entering the terminal. Simulated Flight participants (SF participants) were met at a prearranged date and time, were told to act as if they had baggage to be checked-in and reminded to fill out an outgoing passenger card. On the day, the participant was met, given information about the flight they would be required to ‘catch’ and was fitted with the Tobii eye tracking glasses. Participants were asked to navigate through the departures area, completing necessary processing activities, as well as going to any discretionary activities they would like to. The researcher followed each participant, standing about one metre behind them. This close proximity enabled the

researcher to prompt verbal protocol, as well as to comply with airport security requirements.

After navigating to their correct check-in desk SF participants were given a simulated boarding pass with time they were required to be at the boarding gate. On the simulated boarding pass, the boarding gate number was not given. This detail was omitted to identify how participants used the environment to navigate. RF participants used the flight information they had previously acquired and the boarding pass they received at check-in. Simulated Flight participants were not required to stand in line and wait at check-in. With reduced processing time, SF participants were given roughly 1 hour before being required at the boarding gate. For actual passengers, they were asked to be at security within 50 minutes of the recording starting. The recording was stopped when the participants had to pass through the security screening and customs processes.

For both SF and RF passengers, the glasses were removed just before going though the metal detector in security, and were placed back on after customs due to restrictions in video recording the customs area. SF participants did not have to pass through the custom control area (as only passengers leaving the country enter this point), and were instead taken by the researcher through an alternative path to enter the airside of the terminal. While Real Flight participants passed through the custom control area, the battery for the glasses was changed. Upon enterning airside discretionary, Real Flights participants were met by the researcher, the glasses were reapplied and the participants were instructed to be at the boarding gate within 50 minutes. The participant then was free to navigate through airside of the terminal until the required boarding time of the flight. The observation was completed when the participant arrived at the boarding gate, had finished navigating through the airport and was now waiting to board the plane. After the recording was stopped, the participant completed the Airport Environment Familiarity (AEF) questionnaire and a short semi-structured interview was audio recorded.

Determining Airport Environment Familiarity

To determine each participant's familiarity with airport environments, the AEF questionnaire asked questions about their previous experience with the international airport in question, other international and domestic airports, as well as other transportation terminals (including rail, port and bus terminals). A score of 0 was given if the participant had never used the environment before and 6 given if the participant had used the environment recently or frequently. From the questionnaire, scores were given for each question and added together to provide an Airport Environment Familiarity score for each participant. For the AEF score, participants received a possible score between 0 and 84. A total of 11 questions were used to determine each participant's AEF score, with 3 questions given double weighting due to a high relevance to navigation within the airport environment. Each question was scored on a scale of 0 to 6.

Coding

The video footage was coded in Noldus Observer (Noldus, 2011). A coding scheme was developed based on existing wayfinding literature, as well as visual search literature (Arthur & Passini, 1992; Beaumont, Gray, Moore, & Robinson, 1984; Duchowski, 2007; Hayhoe, Droll, & Mennie, 2007; Wiener, Büchner, & Hölscher, 2009). It has three broad categories of navigation states: (i) Going/doing, (ii) Assessment/acquiring information and (iii) Search (Table 1)(Cave et al., 2013). Each Going/doing and Assessment/acquiring information action was categorised as intuitive, partially intuitive or not intuitive. Search was categorised as focussed or unfocussed. Coding was undertaken over a 4 month period, cross-coded by two researchers. An inter-rater reliability analysis using the Kappa statistic was performed to determine consistency of coding between the two raters. The inter-rater reliability for coding by the two raters was found to be Kappa = 0.71 ($p<.001$).

Landis and Koch (1977) consider Kappa values of between 0.60 to 0.79 to indicate substantial agreement between the raters.

Table 1: Navigation states

Navigation State	Description	Example	Sub classification	Example
Going/doing	Identified point or area to navigate to and moving towards it	Visually identified check-in row to navigate to. Moving to correct check-in row	Intuitive	Moves to next point without verbalising, navigates confidently to next step correctly
			Partially Intuitive	Not certain that point is correct point to navigate to
			Not Intuitive	Not certain or logical reasoning used
Assessment/ acquiring information	Fixated on sign, object or area, extracting information from a source	Looking at sign for information. Locate flight number and find corresponding row number	Intuitive	Acquires information fast, with minimal verbalisation
			Partially Intuitive	Takes time to locate information, or decide how to use information
			Not Intuitive	Cannot find useful information from sign or takes significant time to find information
Search	Searching for a place or sign, information or clue as to what to do or how to use the area	Search for sign to locate which check-in desk to use	Focussed	Looks at limited number of points in area. Focuses on likely areas for information.
			Unfocussed	Looks at range of seemingly random points, searches across a range of points in the surrounding area

Participants' Airport Environment Familiarity

Based on their AEF score, participants were categorised into 3 groups (Table 2): (i) Low familiarity (LF), (ii) Medium familiarity (MF) and (iii) High familiarity (HF). For Low familiarity participants, 50% were first time users of the airport, while both Medium and High familiarity groups each had one first time user of the airport.

Table 2. Airport Environment Familiarity categories

Familiarity with airports	Number of participants	Example (example only, a number of factors was used to determine AEF score)
Low familiarity (LF) AEF = 0 to 15	8	On average fly internationally every 2 years or less, have not flown within past 2 years
Medium familiarity (MF) AEF =16 to 30	11	Fly internationally from once every 6 months to 1 year. Last flew internationally between 6 months and 1 year ago
High familiarity (HF) AEF =31 and above	11	Fly internationally once every 6 months or more frequently. Last flew internationally between 1 and 3 months ago

Results

In this section, we first describe how the navigation process was visualised through Noldus Observer. Then, we describe the differences in navigation between participants with Low, Medium and High airport familiarity in three activities: (i) navigating from the airport entrance to check-in, (ii) navigating through the LAG preparation area before security and (iii) locating the boarding gate.

Visualisation of the navigation process

After coding the journey of 30 participants, it was possible to compare the sequences of Going/doing, Assessment/acquire information, and Search. The visualisation of the first 30 minutes of navigation by Low familiarity and High familiarity participants is shown in Figures 3 and 4, along with indicators of when the participant arrived at check-in (C), and to security (S). Both figures illustrate how people transition between navigation states while moving though the airport. The figures also show that navigation can be a stop/start process, with breaks in navigation to complete activities.

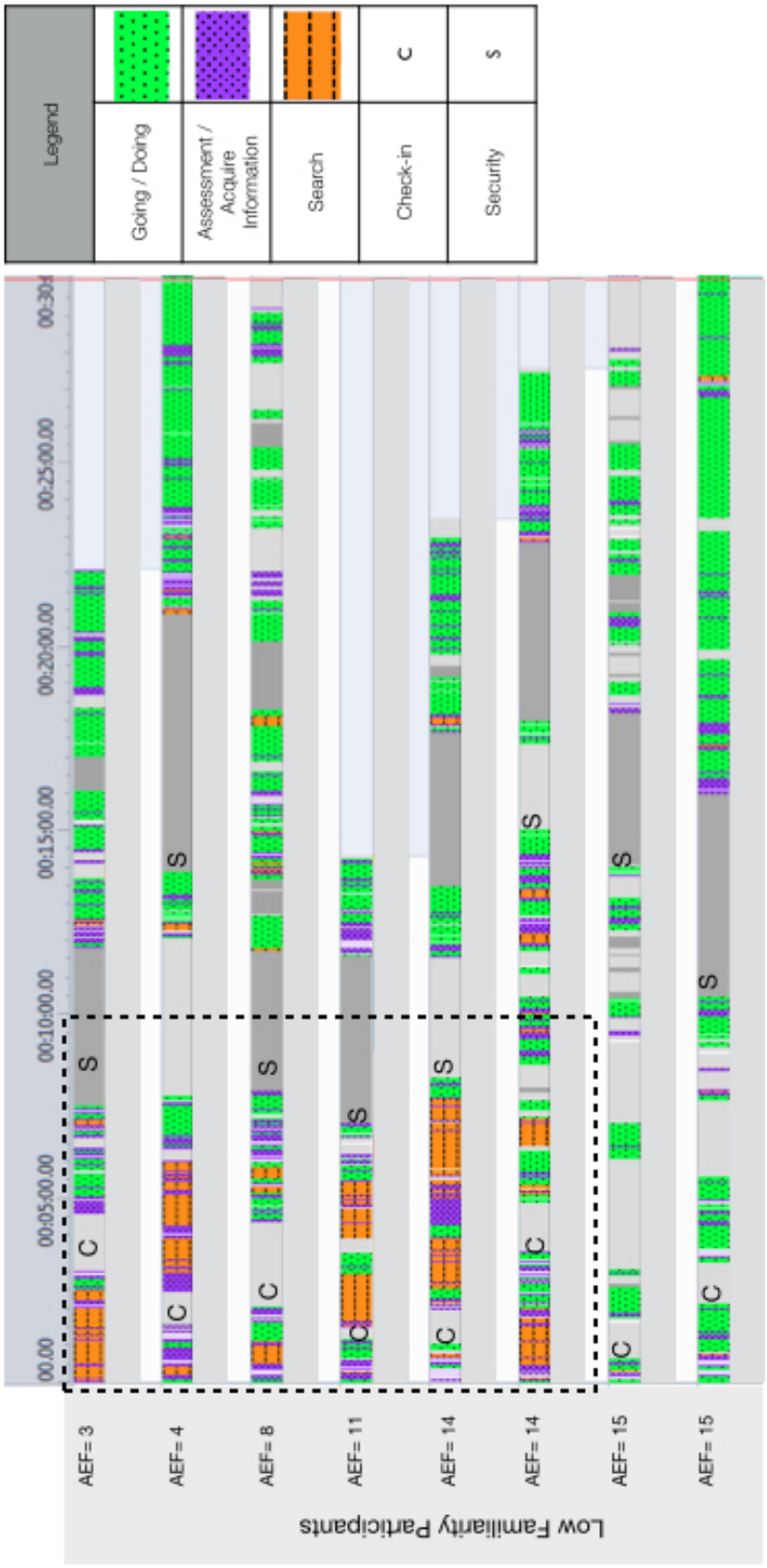

Figure 3. Visualisation of navigation (first 30 minutes) of Low familiarity participants.

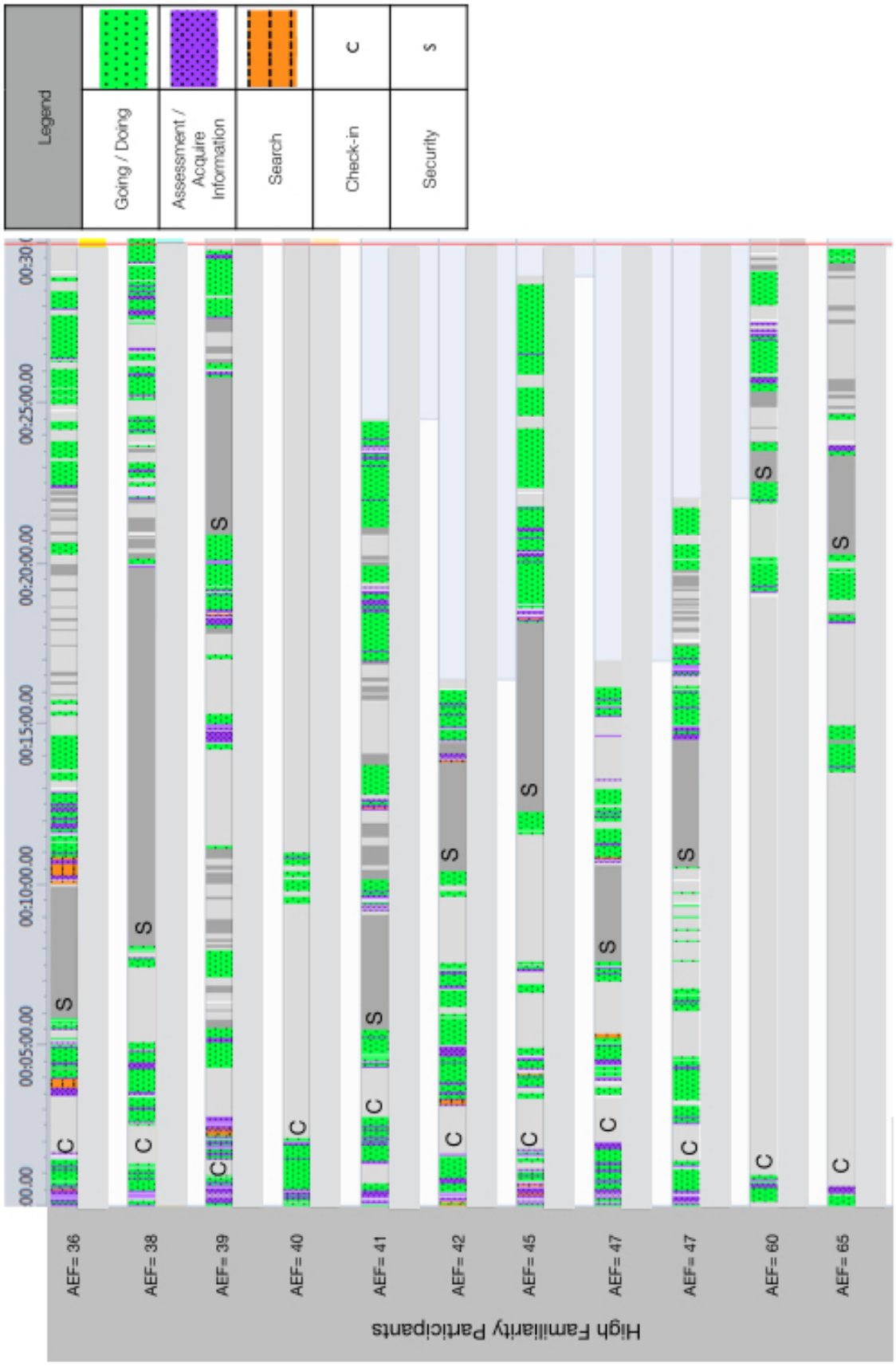

Figure 4. Visualisation of navigation (first 30 minutes) of High familiarity participants

Low familiarity participants (Figure 3) have large periods of Search and Assessment/acquire information along with periods of Going/doing. In this sample of Low familiarity participants, these periods of Search and Assessment/acquire information occurred when navigating to check-in and to security screening, highlighted by the dashed line box in Figure 3. In contrast, High familiarity participants (Figure 4) have long periods of Going/Doing, interspersed with shorter periods of Assessment/acquire information throughout the navigation process. High familiarity participants also had little search present.

Navigation Activities

Figures 3 and 4 show that there are differences between Low and High familiarity participants when navigating, indicating the need to examine the navigation process in further detail. Three activities completed by all participants were chosen for examination. The first activity examined was navigating to the correct check-in desk. In this airport, there are 10 rows of check-in desks, with each row usually allocated to one airline. Each check-in row has multiple check-in desks where passengers complete the check-in process. Participants were timed from when they entered the check-in area to when they arrived at the entrance for the line to the correct check-in desk, or in the case of one participant, to the queue that extended out of the designated area.

The second activity examined was navigating through the LAGs (Liquids, Aerosols and Gasses) preparation area. In Australian international airports, passengers who have LAGs (that comply with government regulations) are required to place them in the plastic bag for security screening. In this particular airport, before entering the line for security screening, passengers pass through the LAGs preparation area where plastic bags for LAGs and benches for LAGs preparation are provided. Passengers who have LAGs move to one of the benches to prepare before moving on, while those without LAGs proceed straight through to the queue to the security screening area.

The third activity examined was the destination passengers chose to navigate after entering the airside area of the terminal (after exiting the customs area). Passengers had a choice of what to do next, either to navigate to a discretionary activity, or to navigate to the next processing step, which is the boarding gate for their flight. Passengers who locate the boarding gate may then engage in discretionary activities, either at the boarding gate or after navigating to another point in the terminal. Harrison et al. (2013) described how the overriding passenger concern was “Will I make my flight?”, and analysis of this activity will identify if there are differences related to familiarity with airports.

Navigating from entrance to check-in desk

There were three ways in which participants navigated to their check-in row. The first way was to locate check-in by sighting airline information, such as signs or logos, on or around each check-in row (Figure 5). Participants walked along the check-in area, looking at each check-in row to determe which airline it was for and whether it was the airline they were flying with. One drawback of this method was that it could be time consuming, with some participants having to examine check-in rows of several other airlines before finding the correct row.

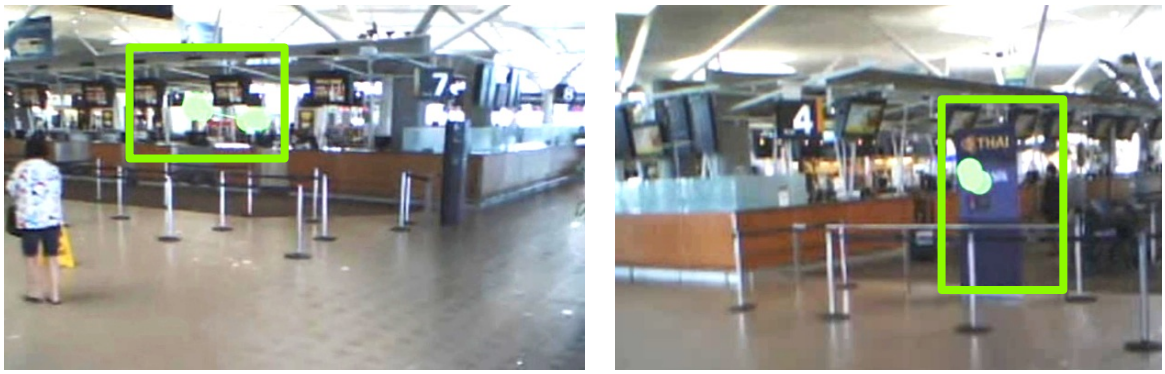

Figure 5. Navigating to check-in by looking for airline associated visual cues (left). Green box shows location of eye-tracking trace. Examining airline sign at check-in row (right).

The second way of locating the check-in row was by examining the large Flight Information Board (FIB), acquiring the row number of the check-in row, and then locating the check-in row associated with the row number (Figure 6). There was also a third way where a participant first scanned the check-in rows looking for their airline, then subsequently switched to looking at the FIB, located the row number, and then located the check-in row using the row number.

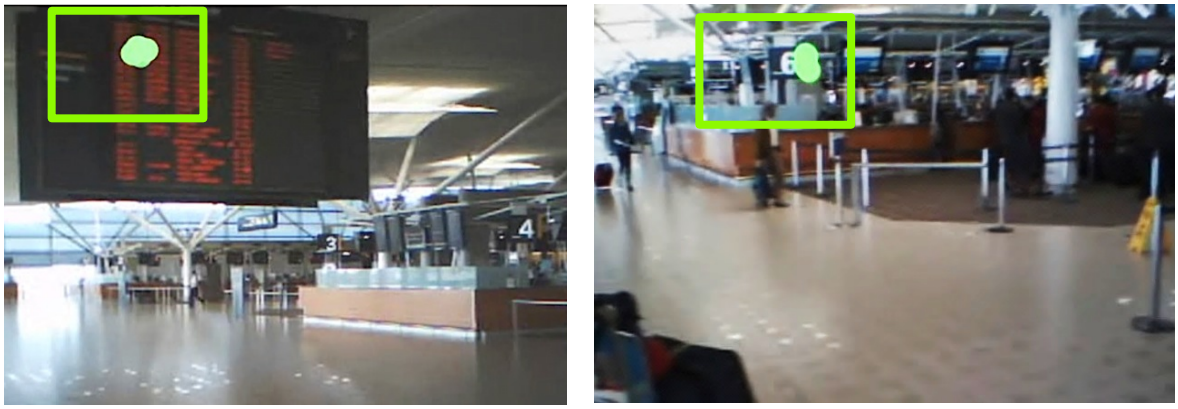

Figure 6. Looking for check-in row using the Flight Information Board (FIB), and acquiring check-in row number (left). Looking at row number associated with check-in desk (right).

Examining which actions the Low, Medium and High familiarity groups took, trends begin to emerge (Figure 7). Half of the Low familiarity participants (50%) tried to locate check-in row by looking at the check-in row for airline information, then switched to looking at the FIB and using the row number. In contrast, no High familiarity participants switched methods of finding the check-in row, and the majority (80%) examined the FIB and used the row number to locate the check-in desk.

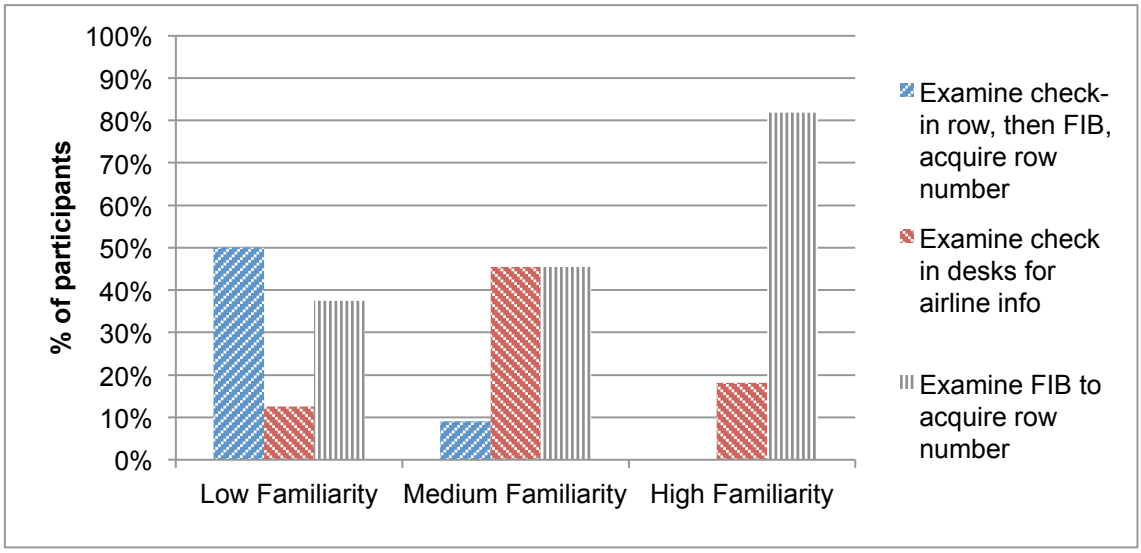

Figure 7. Percentage of Low, Medium and High familiarity participants and visual elements used to locate the correct check-in row

It was found that Low familiarity participants on average took longer to navigate to the check-in desk (Figure 8). Medium and High familiarity took similar amounts of time (mean of 1m 36 s and 1m 32 s respectively) to get to the correct check-in desk. In contrast, Low familiarity participants took on average 1 m 56 s to navigate to their check-in desk, which is on average 19 seconds, or 20% longer than Medium familiarity, or 25% longer than High familiarity participants. In addition, 50% of Low familiarity participants took longer than 2 minutes to navigate to their check-in desk, in contrast to Medium (18%) and High (9%) familiarity participants (Figure 9).

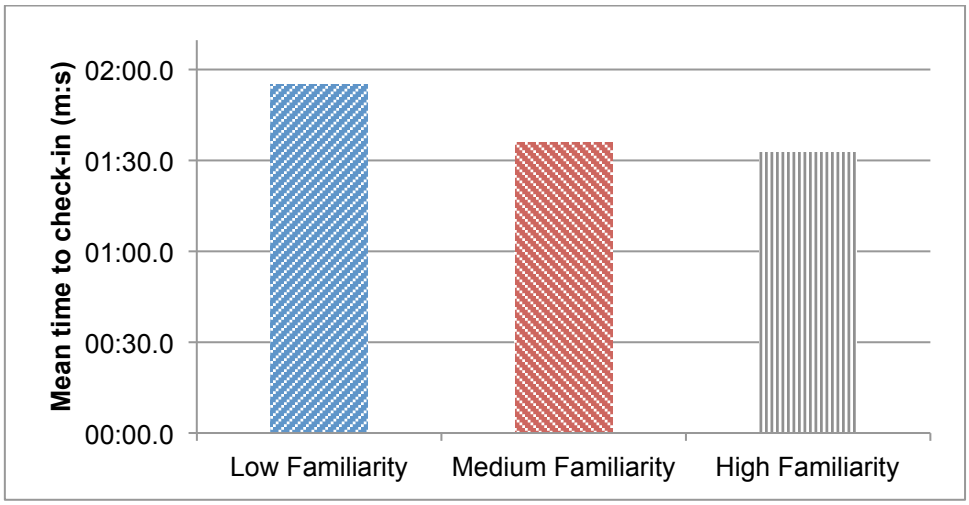

Figure 8. Mean time to navigate to the correct check-in row for Low, Medium and High familiarity participants

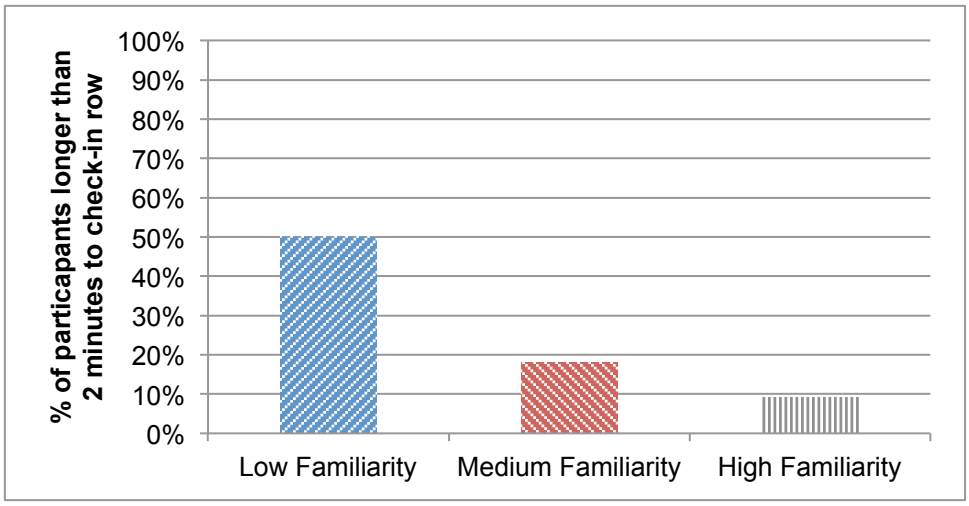

Figure 9. Percentage of Low, Medium and High familiarity participants that took longer than 2 minutes to navigate to the correct check-in row.

Moving through LAG preparation area before security screening

In this airport, after checking-in, the next main processing step passengers complete is security processing. To navigate to the security processing area, passengers pass through the Liquids, Aerosols and Gasses (LAGs) preparation area. Figure 10 shows the areas for LAGs preparation on the left and right (highlighted by boxes with solid lines), while the entrance to the queue for the security preparation area is in the distance (centre of the image, highlighted by dashed box).

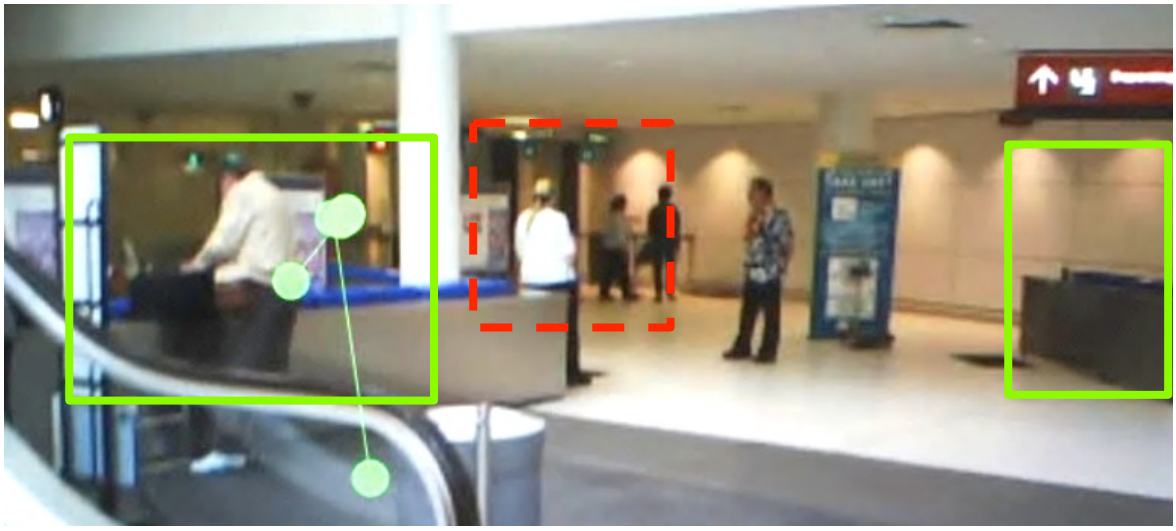
Figure 10. Examining LAGs preparation area, located before entry to the security screening line. Boxes with solid lines (left and right) show LAGs preparation area while dashed box (center) shows the entrance to the security line queue.

When moving towards the area provided for preparing LAGs, some participants misinterpreted the visual elements within this area. The presence of certain visual elements, including benches, blue trays (commonly used for unpacking items including LAGs as well as other items), security officers, passengers at the benches doing preparatory activities, as well as archways (at the start of the security line) gave some participants the impression that the LAGs preparation area was the security preparation area. Participants were found to do one of three actions: (i) proceed straight through the

LAGs preparation area without stopping, (ii) hesitate, stop to examine the area and then continue to the queue for security preparation, (iii) navigate to the LAGs preparation bench and blue trays (Figure 11).

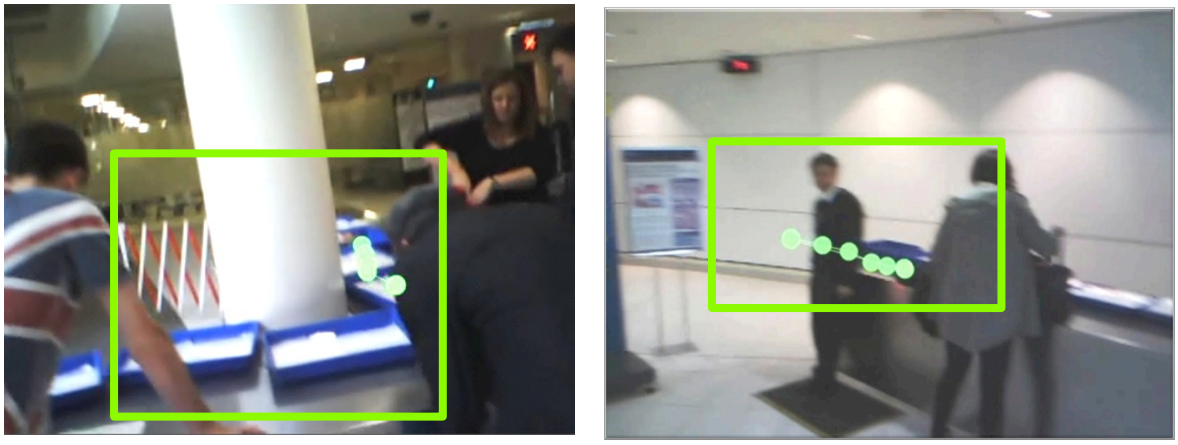

Figure 11. Moving towards blue trays and preparation bench in LAGs preparation area. Box shows location of eye-tracking trace on LAGs preparation area (left). Examining blue trays and security screening officer (right).

Each group had a similar percentage of participants go straight through the LAGs preparation area (Figure 12). Compared to the Medium and High familiarity groups, a higher number of Low familiarity participants were found to hesitate before moving on. 36% of Medium familiarity and 27% of High familiarity participants navigated to the LAGs preparation bench and examined the bench before moving onto the security screening line. Despite their experience as airport users, a number of Medium and High familiarity participants confused the LAGs preparation area with the security preparation area.

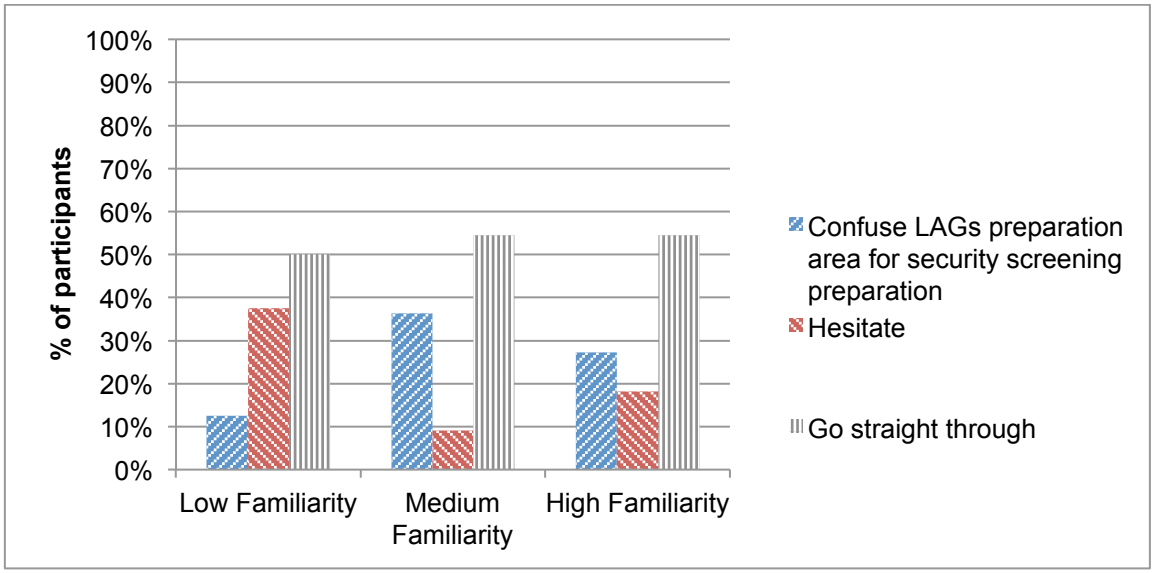

Figure 12. Actions associated with Low, Medium and High Familiarity participants in the LAGs preparation area.

Locating the boarding gate

After exiting the customs area and entering airside, participants had time to spare before boarding. Participants would either (i) navigate to, and visually sight the boarding gate for their flight, after which they could navigate to a discretionary activity (e.g. retail), or wait

around the boarding gate, or (ii) navigate to a discretionary activity first, such as retail or to a food outlet, before navigating to the boarding gate later. Examining the groups, the majority (71%) of Low familiarity participants were found to navigate to the boarding gate first, before considering navigating to another activity (Figure 13). In contrast, the majority of High familiarity participants (73%) navigated to a discretionary activity first, before eventually navigating to the boarding gate. Medium familiarity participants were split more evenly, 55% navigating to the boarding gate first and 45% navigating to a discretionary activity first.

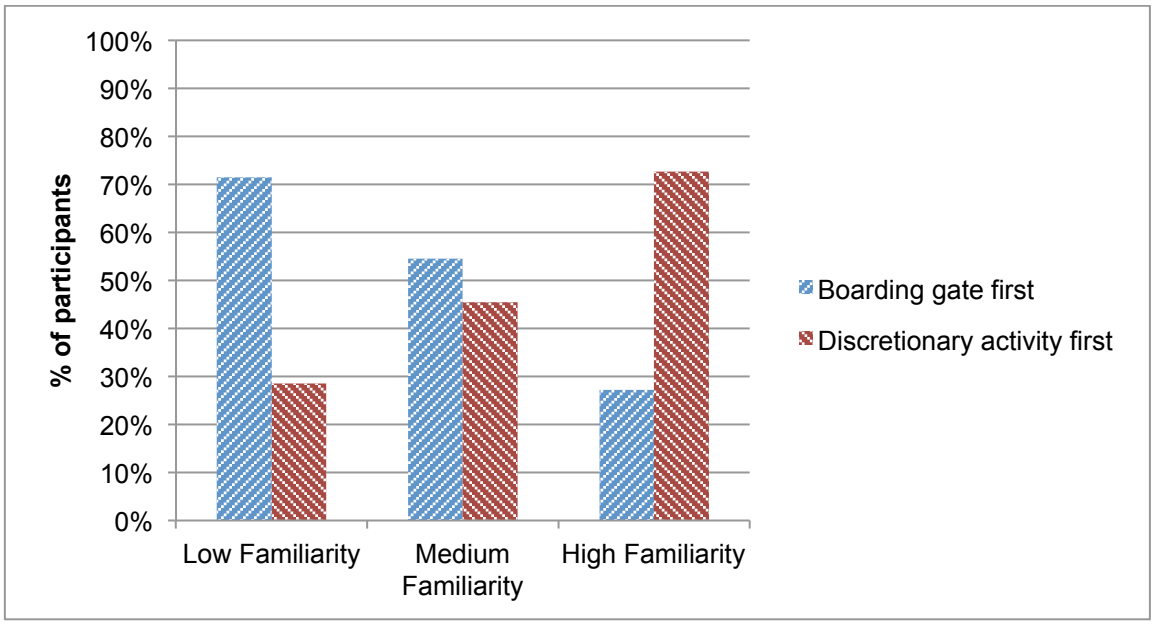

Figure 13. First destination after exiting customs.

Discussion

While each participant made it to the boarding gate, there were differences in how this was achieved. Participants with Low familiarity spent more time searching for what to do and where to go, particularly navigating to check-in and to security screening. In contrast, High familiarity participants spent little time in Search and spent more time Going/doing. With clear differences in the navigation of Low and High familiarity participants established from the visualisation (Figures 3 and 4), three activities were examined in further detail (i) navigating to the check-in row, (ii) navigating through the Liquids, Aerosols and Gels (LAGs) preparation area before security screening, and (iii) navigating to either the boarding gate first or to a discretionary activity first, after exiting customs.

All participants identified that they needed to go to check-in, but there were differences in how this was achieved between the Low, Medium and High familiarity groups. This shows how people can use alternative visual elements in the environment (e.g. airline specific signs or Flight Information Board with row numbers) with different types of information, to identify where to go. This indicates that airports either need to provide better indication of which visual elements passengers should use, and/or that airports need to accommodate different navigation strategies. If airline icons and text were more visible around the check-in desk, it is possible that a number of participants would have found the check-in row without using the large Flight Information Board.

Navigating through the LAGs preparation area participants of all familiarity levels either hesitated before or tried to unpack at the LAGs preparation bench. While Low familiarity participants might be expected to navigate to an incorrect destination or take time to work out what activities occur in an area, this also occurred to a substantial proportion of

Medium and High familiarity participants. This highlights how important certain visual elements, and the combination of elements in the surrounding environment can be for navigation. It also provides evidence that passengers use visual elments other than signage to make decisions when navigating. Airports need to ensure that anticipated visual elements are placed in appropriate locations to avoid confusion. In the LAGs preparation area, there were no prominent signs to indicate what the area was for i.e. a large signs with writing such as “Prepare liquids, aerosols and gasses here, then continue on to security screening”. In the absence of labels, or clear instructions, people appeared to use their own knowledge to fill in the next step, or navigate to where staff and other passengers were doing activities.

The different destinations passengers chose to navigate to after exiting customs, that is their boarding gate of discretionary activities, indicates the need to understand the navigation priorities of passengers. Some passengers may not want to take part in discretionary (e.g. retail) activities until after they locate their boarding gate, which reinforces Harrison et al.’s (2013) finding that passengers are often concerned with “Will I make my flight?”. For some passengers this concern may not be satisifed until they are physically at the correct gate. This ‘boarding gate fixation’ has potential implications for the layout of the airport and where retail areas may be located. In addition, this result suggests airports should ensure that low familiarity passengers can locate information on how to get to find boarding gates after exiting the customs area.

Implications for design

Benefits of incorporating intuitive navigation in airport terminal design could include faster and easier passenger navigation. These findings provide evidence that passengers who navigate intuitively spend less time searching for visual elements to use, and navigate to processing points faster. This could be highly beneficial as the size of airports continues to grow in response to increasing passenger numbers. Additionally, if passengers spent less time navigating, then they could spend more time in discretionary activities, for example relaxing or browsing in retail areas. Another benefit of intuitive navigation is the potential to minimise delays caused by passengers who arrive late to their departure gate. Further, by designing for intuitive navigation, airports can minimise costs associated with providing ineffective navigation aids, adding unnecessary additional navigation aids and/or replacing ineffective navigation elements such as signage.

To implement intuitive navigation, airports must understand and address the navigation needs of both Low, Medium and High familiarity participants. In particular, airports must ensure Low familiarity passengers are able to find out what to do and where to go to complete the required activities. By understanding the navigation needs of passengers, airports can provide suitable visual elements for different needs or strategies (for example by providing both row numbers and prominent airline information on each check-in rows). Increased knowledge of how passengers navigate is also required to ensure that elements associated with certain activities are used in appropriate areas, and that areas with different activities are differentiated to avoid passenger confusion (for example in the LAGs preparation area). Implementing intuitive navigation also requires designing for passengers with different navigation priorities and enabling passengers to navigate to different points quickly and efficiently, for example by ensuring passengers can easily find their way to the boarding gate after customs, and then still return to retail or other discretionary areas.

Conclusion

Passengers, airlines and airports can benefit from understanding intuitive navigation within airport terminals. Intuitive navigation has the potential to improve passenger experience, reduce spending on ineffective navigation infrastructure, and reduce costs associated with passengers not being at the boarding gate on time. Low familiarity participants were found to search for visual elements, while High familiarity participants were able to locate visual elements without searching. It was also found that passengers can use different visual elements in the environment when navigating. While all participants used signage when navigating, this research also identified that participants used other visual elements, including structures, spaces and the presence of other people, including passengers and staff, to support their navigation.

This research has identified aspects of airports that could be changed to improve intuitive navigation for both inexperienced and experienced passengers. While this paper has examined some areas commonly found in airport terminals and visual elements in those areas that passengers use in navigation, further research should examine the environmental elements used in each step of the airport process. Our findings, while focussed on airports, have implications for other large spaces in which people navigate, including transportation terminals, hospitals and shopping centres. Understanding and providing intuitive navigation has the potential to make everyday navigation easier for everyone.

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Andrew Cave is currently completing his PhD, which examines how passengers intuitively navigate through airport terminals. He is a team member of both the People and Systems Lab (paslab.com.au) and the Airport of the Future project, located at the

Queensland University of Technology. In 2010 Andrew received an Airports of the Future scholarship. Andrew has previously completed both a Bachelor of Science at the University of Queensland, and subsequently a Bachelor of Design (Industrial Design) (Hons) at the Queensland University of Technology (ar.cave@qut.edu.au).

Alethea Blackler (PhD) is an Associate Professor in Industrial Design at Queensland University of Technology, Brisbane, Australia. Her principle area of research interest is intuitive interaction, in which she is one of the world leaders. She pioneered the work on intuitive interaction with the first empirical work in the field. She leads the Intuitive Internaction theme in the People and Systems lab at QUT. Associate Professor Blackler has led a prestigious ARC Discovery project on Facilitating Intuitive Interaction for Older People. She is continuing work on developing design methodology for intuitive interaction as well as applying intuitive interaction into other areas, such as navigation and expertise. She has published extensively, been invited to give presentations at international workshops in Europe and is the recipient of several awards. She has regularly reviewed papers for international conferences and journals. Associate Professor Blackler is a member of the Design Research Society (DRS) (a.blackler@qut.edu.au).

Vesna Popovic (PhD) is a Professor in Industrial Design at Queensland University of Technology, Brisbane, Australia. She has made an international contribution to product design research where she has integrated knowledge from other related areas and applied to the artifact design (e.g. human factors/ergonomics, product usability, design and cognition, expertise and experience, design computing or applied design research) in order to support and construct design applications. Vesna has been leading Human Systems Program in the ARC Linkage project “Airports of the Future” where she has been focusing on people’s experiences at an airport terminal. She was a joint recipient of the 2011 Engineers of Australia Queensland award for R&D for a pilot study ”Airports of the Future”. Vesna has been a founder of People and Systems Lab research at QUT. The impacts of Vesna’s research lies in the cross-fertilisation of knowledge across humanities and technologies to design humanised artifacts/ systems by facilitating the understanding of diverse expertise and experience. Vesna is a Fellow of the Design Research Society (UK). She is recipient of three Australia Research Council grants (v.popovic@qut.edu.au).

Ben Kraal (PhD) is a Research Fellow with the People and Systems Lab at QUT. His PhD looked at the lived experience of people who use speech recognition software every day and at how speech recognition software could be made more useful for daily work. More recently Dr Kraal’s work has focussed on how people experience complex systems and services with a focus on airports and healthcare. He was a joint recipient of the 2011 Engineers of Australia Queensland award for R&D for a pilot study ”Airports of the Future. Dr Kraal’s work on airport passenger experience has been highly influential and achieved significant impact in the industry. In the healthcare domain Dr Kraal has focussed on the experiences of patients, nurses and doctors and other stakeholders in several projects. Notable examples include identifying expertise in nurses applying compression bandages, performing user-testing for a prototype telehealth stethoscope and investigating eHealth system experiences of people with an intellectual disability. Dr Kraal’s work is situated at the intersection of design and qualitative sociology and draws on both disciplines to reveal how systems and services are made and made useful. (b.kraal@qut.edu.au)